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COMMUNICATIONS

A DIFFICULTY IN ACCEPTING THE YOUNG-HELMHOLTZ THEORY

BY

SIR GEORGE ANDREAS BERRY,

EDINBURGH.

NOT very long ago* I discussed at some length the question of colour vision, but without reference to hypotheses or theories. As the subject has been recently before the readers of the BRITISH JOURNAL OF OPHTHALMOLOGY, I venture to call attention now to what, to my mind, is the weak point of the Young-Helmholtz theory.

Our present position with regard to inferences to be drawn from experimental data must, I take it, be to ascribe to the retinal rods an end-organ function in connection with neutral, non-coloured, light impressions and to the cones a similar end-organ function, but in addition a functional relationship to qualitative light or colour sensations. This latter function alone, presents, as one of its essential features, the phenomenon of antagonism. What the explanation of this phenomenon may be, whether the antagonism takes place in the end-organs or in the visual centres, is one of the puzzles which remains to be solved. Popularly, we talk of one colour destroying another. In point of fact, all colour impressions when superimposed, destroy each other in some degree. The

* Bowman Lecture. *Trans. Ophthal. Soc.*, Vol. XXXVII, 1917.

actual degree varies from slight, in the case of impressions which are nearly alike, to complete destruction in those which are dissimilar to the extent of being complementary. These latter are often indeed referred to as "antagonistic." The full extent of antagonism, though present, is only noticeable when the superimposed colours are of equal "strength."

The problem of explaining colour vision is one that has for long been attractive both to the physiologist and the mathematician. Unfortunately it is rare that the mathematician who attacks the problem has a sufficient knowledge of physiology quite to appreciate the difficulties which call for solution. On the other hand, it is not uncommon to find a physiologist to whom the subject is specially interesting, unable fully to understand the mathematician's point of view. Helmholtz was both a physiologist and a mathematician and the same applies to Thomas Young, though in his day physiology was a somewhat rudimentary science.

It is really preponderatingly a physiological problem. And much of the confusion that exists comes from the uncertainty as to whether some element in the chain of events leading to colour perception is retinal or central. It seems doubtful whether the great mathematical development that the colour problem has received from Helmholtz and his pupils and others, though highly suggestive and research stimulating, has really been necessary. Because, the attempt to explain at the same time both colourless and coloured impressions by the interaction of the same postulated variables is inconsistent with what is known of the physiology and pathology of colour vision.

The idea of the complete causative interdependence of the two kinds of sensation probably originated with Newton 250 years ago. Newton suggested that the impingement of light on the refracting surfaces of the retina sets up vibrations of different sizes which run along the optic nerve fibres to the sensorium, causing different colour sensations according to their size, "while a confusion of all caused white."

Of course this is not consistent with what is now known of a specific nerve energy. But it was the consideration of this suggestion that led Thomas Young to propound the view that "each sensitive filament of the nerve may consist of three portions, one for each principal colour." And 50 years afterwards, now nearly 70 years ago, Helmholtz, when he resuscitated and elaborated the hypothesis of Young, retained this conception of Newton's as an essential part of the hypothesis which is now known as the Young-Helmholtz theory.

Helmholtz, however, made an important modification in the hypothesis. The three postulated receptors were retained, but only in a general sense, without any assumption as to their nature, such

as distinct nerve fibres, three different chemical or electrical changes, &c.

In this general sense the hypothesis lends itself to mathematical treatment. At the same time it becomes, so to speak, more elastic. The elasticity is necessary to explain and correlate abnormal conditions of the colour sense and other phenomena with normal colour vision. But is this elasticity not of itself a little suspicious?

We can probably never hope to understand the cerebral psychical processes which result in the extraordinary number of separate colour impressions which we can perceive. The only question that might, and possibly eventually will be elucidated, is the discovery of the nature of the provision that exists for the retinal reception of the "light" stimuli, and their transformation into nerve energy, which finally elicits these sensations.

Physiologically there is a very complete similarity between the black-white series of impressions and the colour series. Black and white are just as definite specific sensations as red or blue or any other colour. And the relation between black and white appears to be exactly the same, physiologically, as that between any pair of complementary colours. Black, physiologically, is the complement or antagonist of white. Like any objectively elicited colour sensation which is always capable of being heightened in its saturation by a purely subjective addition, the black and white sensations are similarly subjectively intensified. This is very striking as regards black.

"White" is more or less a relative sensation, produced by an illuminated object or surface devoid of colour. But it is possible to approximate to, and easy to imagine, an absolutely pure white. Any colourless impression, from white to very dark grey, may, under special conditions of illumination, of contrast and of retinal adaptation, appear to be white. And however pure the white of a surface may appear, it is always possible to elicit the sensation of a still purer white. An increased sensation of white is got by screening off a portion of a white surface for a few seconds by interposing a grey or black object. On removing the screen the portion which it covered appears then more brilliantly, more saturatedly white, than the rest of the surface. That fatigue is not the only factor in causing this increased saturation is shown by making the same experiment with black. "Black" is also under most conditions a relative sensation. But it is possible to obtain a practically absolute black, i.e., it is possible to present to the retina a surface from which no light at all is reflected. Yet this, which one might call a physical black, is not as black a black as it is possible to experience. It is not a fundamental black in the physiological sense. The retinal image of a hole in the middle of a box, the inside of which is darkened with mat lamp-black, provides

an absolute, or very nearly absolute, physical black. If over a portion of such a hole we hold a screen of white paper for a few seconds, the area covered appears, on the withdrawal of the screen, a great deal blacker than the rest of the hole. Here there can hardly be any question of fatigue.

The simultaneous effect of objective conditions capable, separately, of giving rise to two equally strong and exactly complementary impressions is to cause a colourless impression. And this has its analogy in the grey that results from mixing black and white. Just, too, as we can imagine an absolute white and an absolute black perception, so we can conceive some definite grey sensation which would result from conditions tending to elicit equal and simultaneous pure black and pure white sensations.

There is, therefore, this close analogy between the colourless and the coloured series of light impressions. But there are also differences. In the first place, the black-white series is one, which, though quite independent of the absolute amount of light, passes from darkness to light—from the absence of any light sensation at all to a greater and greater sensation of light. The neutral line in any concrete case corresponds to the impression of some definite grey. So far, then, as the end-organ excitation which originates these impressions goes, it can only be imagined as taking place for the one end, the white of the series.

In the case of two-colour impressions having the same relationship to each other as black and white have to each other, i.e., qualitative impressions which are mutually complementary or antagonistic, there is light at both ends of the series, because there can be no colour without light, though there may be light without colour. The result of this is that the neutral line or division between the two impressions, which is, as before, uncoloured, is, so far as light goes, brighter than would be the impression produced by one of the colours alone. There is, in fact, a summation of the two lights, with, at the same time, a destruction of qualitative impressions—the colour of each. There is, therefore, presumably end-organ stimulation at both ends of the series. Combination of any two colours produces an intermediate colour whose brightness is the sum of that of the components. This is the case whatever be the qualitative character of the resultant. Abney has shown that "within the limits of error of observation, the luminosity of the combined spectrum, measured as white, is equal to the luminosity of spectrum colours measured separately."

The black-white grey, therefore, though the same psychically as that resulting from combining two equally strong complementary colours, has a different relation to that of its components. The concomitance of the two conditions which would cause the two sensations black and white, results in a sensation which differs from

either, but yet is one which for varying proportional activities of its two components has always the same character.

How is the neutral effect of simultaneously superimposed stimuli which would, separately, cause impressions of two complementary colours, or of many colours suitably selected to produce this effect, to be explained? It seems generally to have been inferred since Newton, that they make "white," i.e., a non-coloured light sensation. It is surely more consistent with what we now know to say that the stimuli to colour impressions destroy each other and "leave" white. Antagonism of action is a common and necessary physiological process. How far antagonism may take place in the end-organ response to simultaneous stimuli is not known. Probably it takes place elsewhere.

One of the main difficulties in accepting the Young-Helmholtz theory is just this assumption on which it is based, that stimuli which acting alone would cause the sensation of colour may, when combined, "make" white.

Some of the differences between neutral and coloured sensations may be noted. In the first place, a physical stimulus, which otherwise would give rise to a sensation of colour, produces a neutral sensation alone, when insufficiently strong. It is a familiar experience that when the light is sufficiently dim colours are unrecognizable, and only the white-black series of impressions are elicited. Snow gives rise to the sensation "white" even when the illumination is insufficient for the recognition of any colours. "Bei Nacht sind alle Katzen grau."

There is for all colours an interval between the general (light) and the specific (colour) thresholds. The magnitude of this interval (the photo-chromatic interval) varies with the different parts of the spectrum. It varies, too, according as the colour is seen by the centre or the periphery of the retina, being in fact barely perceptible for the fovea. It varies with the state of retinal adaptation. Still more strangely the relative brightness of the spectral hues varies with the absolute illumination.

Again, when the stimulus is too intense the colour impression which it would otherwise produce is lost. All colours tend towards white when light is intense.

Further, neutral light perception exists equally all over the retina, being dependent, in the first place, upon changes which occur by the action of light on the hexagonal pigment cells. This pigment cell layer is the only one that is continuous throughout the retina.

Again, colour perception varies, both quantitatively and qualitatively for different parts of the retina, And, it is the specifically coloured factor of the complex sensation that varies—the black-white factor remains constant.

Pathological conditions show too, a certain independence between the neutral light sense and the colour sense.

All these facts, as well as others, appear to indicate that there is some sort of differentiated origin for the two series of sensations. As the same light stimulus originates only non-colour impressions when acting through the rods, but both colour and non-colour impressions for cone excitation, from which the resulting sensations are always more or less mixed, the independence of the two sensations is subject to limitation.

Whilst then the same energy provides the physical stimulus for eliciting both neutral and coloured visual sensations, and although there is a close analogy and similarity between many of the physiological effects of the stimulus in the two cases, it surely does not follow that the one is strictly speaking dependent upon the other. Physiologically the effects of both responses to the stimulation are inseparably associated in the final character of the sensation. In addition to colour hue there is always some admixture of uncoloured light sensation, the effect of which is to add a practically limitless series of shades and tints. In the case of the spectrum colours it is no doubt difficult to detect the presence of an uncoloured element. But it is there all the same, and it is this element which accounts for luminosity apart from colour saturation. It has received the name of "white valency."

Just as black, though a definite sensation, has no physical counterpart, so no relation has been found between changes in the wave lengths of luminous energy and colour sensations. In fact, the rate at which change in perceivable hue takes place for different wave length varies within very wide limits. It varies too, in an altogether intermittent manner. Our colour sensations form a complete re-entrant curve. The spectrum, on the other hand, leaves a not inconsiderable gap. It does not elicit all the pure colour sensations which we normally receive.

Our idea of primary or fundamental colour sensations, if such exist at all, must be a purely physiological one. It cannot be based on the colours found in the spectrum. Beginning with Thomas Young himself there has been much speculation, based upon experimental data, as to the three hues to be selected as fundamental. Even the exact wave lengths of these have been postulated. But the selection has always been made on the assumption that one response to all compound colour stimuli must be the "making" of white.

It may, perhaps, be admitted that the inference that separate receptors of some nature exist—but in connection with qualitative light sensations alone—is one to which one seems almost forced by the known facts of colour mixture. It is also easy enough—if we exclude the "making" of white light at the same time—to imagine

a system of a limited number of fundamental sensations which would suffice to explain symbolically both normal and abnormal colour vision. But this is not the Young-Holmholtz theory.

In the theory as it stands the condition of peripheral colour vision is explained in a way which is inconsistent with facts. For the periphery of the normal field of vision there is no difference in kind between the non-coloured impressions and those got on direct fixation. Nor is there any qualitative difference in the two cases for certain hues of blue and yellow, although reds and greens appear at the periphery of a dirty yellowish or dirty blueish hue or altogether uncoloured, according to what may be the actual hue impression that they produce when seen directly. As the black-white perceptions are unimpaired, so also are their combinations with blue and yellow. Thus, a yellow brown and a light blue are not materially altered on peripheral fixation.

The phenomena of peripheral colour vision show that if the power of correctly perceiving any hue is lost, that of perceiving the complement to that hue must also be wanting. If this were not so, then a white object would change in the impression to which it gives rise when passing from the centre to the periphery of the field of vision, or vice versa. That it does not do so is readily observed. Possessing the power of perceiving colour, we should surely at once notice if the peripheral impression were a coloured and not an uncoloured one.

There is nothing to indicate that there is any very radical difference between normal peripheral colour blindness and congenital colour blindness. When the supporters of the Young-Helmholtz theory, as modified to explain congenital colour blindness, assume that the white of the colour blind is different from the normal white, they are led to this quite untenable conclusion by carrying through the same idea as to the making of white. I am not aware whether it has ever been suggested that the colour blind's peripheral white is different from what is normally the case, or that the central white and peripheral white are two distinct impressions. Either assumption would, as it appears to me, be equally absurd, and it is doubtful if even the elasticity of the theory could be stretched so as to meet the second supposition.

If we infer that colour vision is induced by excitation of different end-organs or different elements of the same end-organs or different central connections, some of the preliminary, though only the preliminary, difficulties in understanding the colour sense are overcome. It has to be remembered that the analogy between colourless and coloured sensations lies mainly in the manner of their central production. It is a physiological analogy. The fact that white light is associated with every—even pure—colour sensation, the difference in the general and the specifically

chromatic thresholds, where these differences can be measured, and the differences in retinal distribution of the means whereby colourless and coloured impressions are evoked, all seem to point to a separate or differentiated origin of the two series of sensations. An additional reason for drawing the same inference is the absence of purely light-sense defects in congenital dichromatic vision. Still another is the retention of normal colour vision in some of the pathological conditions in which the light-sense is impaired.

We may represent by analogy, in a simple though perhaps rather crude way, associated and yet independent response to a single force, such as the facts of the excitation to coloured and non-coloured vision by the physical energy, which evokes any sense of light at all, suggest. Take, e.g., a body of any kind, capable of freely gliding, or rolling on wheels, along a horizontal surface. Suppose that attached to this body, and therefore constrained to move with it, there is a vane similar to that pushed along at the end of a stick by children, the whole forming a sort of wind-mill on wheels or gliders. Suppose that a current of air plays against the surface of the body and at the same time directly on the vane. If the air current is sufficiently strong it will cause the body to move along the surface, and at the same time cause the vane to rotate. Let us suppose, further, that the friction which tends to prevent the body as a whole from being put in motion is less than that which would resist the rotation of the vane. The movement of the whole body may be taken to symbolize the non-coloured response to the energy which is the physical basis of light, the rotation of the vane standing for the colour sensation response and the air current for the light energy. The possible adjustments which might be imagined in the relative kinetic responses of body and vane to the air current would take the place, in this analogy, of the differences which characterise the photo-chromatic interval. If the air current, again, was supposed to be very strong, the movement of the body as a whole would be relatively more rapid than that of the vane, a condition which might be taken as representing some analogy to the whitening of very strong colour excitations.

Because it may be more consistent with facts to hold that the energies which would evoke, when separatively active, a pair of complementary colour sensations, or three or more colour sensations, or the whole spectrum, when simultaneously active and superimposed, "leave" rather than "make" white light, this does not exclude as altogether inapplicable the conception of three fundamental receptors for qualitative impressions alone. I am not prepared to admit that even when modified to this extent, what remains of the theory gives a satisfactory explanation, so far as any explanation is possible at all, of all colour phenomena. It may be that the whole idea of a limited number of primary colour sensations is wrong,

notwithstanding the cogent indications suggested by the facts of colour mixing. No one, I hold, can say of any colour that it is consciously more primary than are the hues in its immediate neighbourhood in the spectrum. For instance, the statement, so often made, that in orange one is conscious of seeing a compound, as opposed to a simple, colour, and conscious, moreover, of the presence in the orange sensation of yellow and red, it is to me quite unintelligible. An analysis of my own sensations of colour, unbiassed by theory, causes me to regard orange, as indeed any other colour, as a colour entity.

In any case the Young-Helmholtz theory has to assume that its postulated primary sensations can only be approximately similar to, not identical with, those obtained by the stimulation respectively of three specialised end-organs. Because it assumes that no kind of light stimulates one alone of the terminal receptors. Every colour, it assumes, must be the result of a triple stimulation, though these hues which are most nearly primary arise from a preponderating response of one of the receptors. Though such an assumption is not unimaginable, it does seem to demand considerable modification in our conception of specific nerve energies.

On the other hand, as has already been said, it is quite a reasonable inference to make that separate receptors of some nature exist in connection with qualitative light sensations alone. Admitting this, for the sake of argument, why should three such terminals be selected and not four or any greater number? Obviously the same combinations could be made with four selected primaries as with three. As the whole matter is so conjectural there can be no absolutely convincing argument adduced in favour of only three. But the physiology of the other special senses offers no analogy for the assumption, in regard to them, of even as many as three independent subdivisions of their respective end-organs. Consequently, as for vision, three would be enough, just as a circle is fixed by three points, there is a natural objection to assuming a greater number of divisions. Even Hering's theory, the other of many theories of colour vision which has the greatest number of adherents amongst physiologists, although postulating four so-called primary colours, derives the whole gamut of coloured and uncoloured impressions from the stimulation of three specialised receptors, i.e., of three substances each capable of katabolic and anabolic changes.

Again, when we exclude the necessity for considering the white element, or white valency, of every colour impression it is easier to account, by a three-fold stimulation in varying degrees and combinations, for the complete qualitative series of impressions which it is possible to receive. With this limitation it is no longer

necessary to represent graphically these impressions as points on a curve of the form given by Helmholtz. A simple re-entrant curve, say a circle, as Newton imagined, seems most consistent with observed facts. And such a circle, though it cannot be completed by points representing visible spectral hues, which do not form a complete re-entrant series, can be completed to represent all the colour hues that we can otherwise perceive. That is to say, that, so far as colour hue sensations go, we can begin with one colour and pass on through others till we come to the first again. And this relationship and order of arrangement is one of which every individual possessed of a normal colour sense is more or less intuitively conscious.

In arranging round a circle points to represent the 150 or so hues which may possibly be distinguished in the spectrum, it has to be remembered that the arrangement to be representative of our re-entrant colour sense must be according to hue and not to wave length. It must be a physiological, not a physical arrangement. The reason of this is that the rate at which perceptible change in hue takes place for different wave lengths varies within very wide limits and in an altogether intermittent manner.

But it is not necessary to pursue such a speculative matter as the selection of the three points in the colour circle to represent symbolically the so-called primary sensations. The selection could not be purely arbitrary; it would be conditioned by being brought into accordance with such phenomena as the known effect of mixing colours, the existence of complementary colours, dichromatism, etc. But the three points being merely symbolic, when the idea of selecting them to represent such spectral colours as "make" white is rejected, need not necessarily be denoted otherwise than by letters or numbers.

THE LATE EFFECT OF TAR POISONING ON FISH

BY

M. S. MAYOU, LONDON. and H. NEAME, LONDON.

THE question of river pollution by road tar or its bases has not received much investigation, but at the present time the subject of tar pollution and its effects upon fish is being considered by the joint committee appointed by the Board of Agriculture and Fisheries and the Ministry of Transport to enquire into it, and carry out experiments as to its poisonous effects. The following case which illustrates the late effect of tar poisoning, is therefore, we think, of some interest.

Some two or three years ago a well known Hampshire trout stream was poisoned by tar used upon the road. Fish were taken out in large numbers, dead, dying, and blind. From the description of the condition the blindness appeared to be due to maceration of the cornea. At the time it was proved definitely that the tar was the cause; tar was obtained from the actual road, and experiments were tried upon fish in ponds with the same effect as above described. It was also found that the phenol constituents of the tar—that is to say, those which were soluble in water—were the cause.

At the present time there are many semi-blind fish in the river; they frequently lie out in shallow water, quite uncovered by weed,

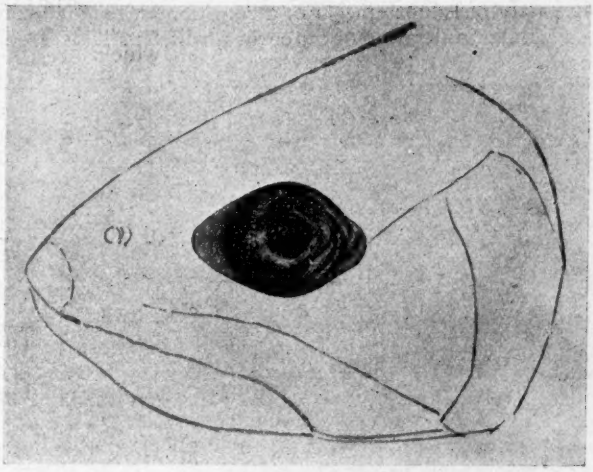


FIG. 1.—Anterior Staphyloma following a perforating corneal ulcer in a trout. Note the secondary pigmentation of the Cornea.

and, of course, will not take any fly on the surface of the water. The trout, the subject of this paper, was a fish of 1½ lb., which ought, according to its length, to have been 2 lb. in weight, very dark in colour, and was lying in the middle of the stream in shallow water. On the left side one could approach quite close to it, and it was evidently quite blind. On the right side, although it could not see an object as big as a salmon fly, when the shadow of a person was thrown across it, it moved off rapidly into the water, and it evidently had a perception of light in that eye. As the fish was obviously of no use for sporting purposes it was removed from the water.

The right eye showed the cornea to be semi-opaque from an old nebula, affecting principally the anterior and lower half of the eye.

This has evidently been the result of corneal ulceration. The left eye was shrunken, and there was a scar in the front and lower part of the eye as the result of an ulcer which evidently had perforated the cornea, and to which the iris had become adherent. There was also considerable pigmentation in the superficial layers of the cornea. There are many fish in this river which do not seem to look at a fly, and no doubt a considerable number of them are semi-blind and are unable to see it.

Pathological Report on the Eyes of a Fish Preserved in Formalin

Microscopic Examination

(1) The cornea is largely denuded of its surface epithelium, probably partly post-mortem. For a considerable extent to one side there is a cellular infiltration of the cornea, which extends deeply to a

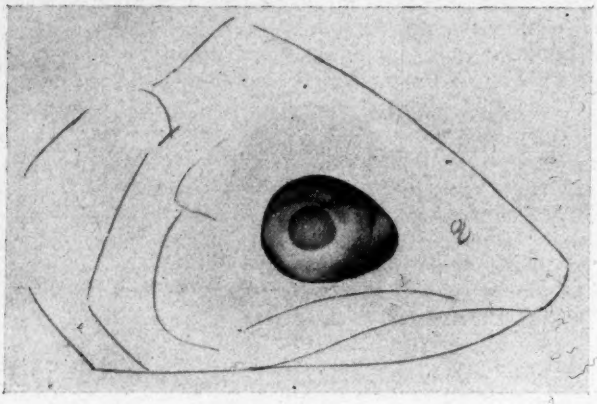


FIG. 2.—Corneal Nebula following ulceration of the Cornea.

wide anterior synechia. The peripheral part of the iris is firmly welded, to an extent of half its radius, to the posterior part of the cornea on this side. In the area of the cornea which shows the greatest amount of cellular infiltration, there are many pigment cells in the superficial layers.

In the opposite half of each of these sections is seen a sheet of fibrous tissue, varying considerably in thickness and shape in successive sections. This is a posterior synechia, widely attached to the posterior surface of the iris near its root, and narrowing as it passes inwards and backwards to the lens capsule. This sheet is largely covered with pigment cells from the pigment layers of the iris.

The forty sections of this eye that were stained and mounted

show that there was anterior synechia with closure of the angle of the anterior chamber for at least a quarter of its extent and, that the sheet-like posterior synechia extended over an eighth of the circumference of the iris.

(2) The condition of the second eye is similar to that of the first, but with a greater vascular reaction in the cornea. In all the thirty sections stained and mounted from this eye there is a marked vascularity over almost the whole of the cornea. At the corneo-scleral junction there is a deep vascularity as well as superficial—in fact, new vessels throughout its depth. On one side the cornea is much thinner in section than on the other, and there is a slight degree of staphyloma. There is patchy pigmentation in the superficial layers.*

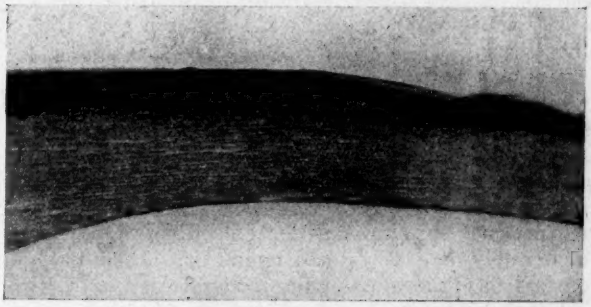


FIG. 3.—Section of the Cornea showing the pigmentation and new vessels in the superficial layers.

The anterior synechiae are chiefly peripheral.

The lens has marked vacuolation of the superficial layers chiefly on one aspect, and to a depth of about one-sixteenth of the diameter of the lens.

Conclusion

In both eyes there is evidence of the occurrence of:

(1) *Ulceration of the cornea.*—In the second eye this must have been very severe and extensive. Apart from the condition of the lens, this eye has sufficient new vessel formation in the cornea to enable one to infer that it was practically blind.

(2) *Anterior Staphyloma in the Second Eye*

(3) *Iritis* with exudate behind the iris.

(4) *Secondary cataract* in the second eye.

* Vascularity of the cornea extending into its deeper layers is not uncommon in inflammatory conditions in dogs and other animals, and the development of pigmentary infiltration of the superficial layers spreading from the pigment cells in the conjunctiva is of fairly frequent occurrence.

SMALL FLAP SCLEROTOMY (RECTANGULAR FLAP SCLEROTOMY)*

BY

H. HERBERT

THIS operation described in the *Trans. Ophthal. Soc. U.K.*, Vol. XXX (1910), p. 199, has suffered from a reputation for uncertainty. But we now know fairly well in which types of glaucoma the failures have occurred; the uncertainty does not apply to all glaucoma. In its restricted field the method seems assured of permanent survival; it requires renewed consideration as one of the means of reducing or abolishing late infections.

It has been in regular use in Nottingham since 1909. Mr. Laws has used the method almost exclusively throughout for all primary glaucomas, acute and chronic. He has repeated the operation when necessary.

To count as a perfect result, not only must there be a lasting reduction of tension to normal, but the filtration must be through uniformly grey scar-lines, without any trace of fistulous openings. The overlying conjunctiva retains much or all of its normal transparency; and the thickening from oedema is commonly moderate.

Our experience has shown perfect filtration to be assured from even moderately well performed operations in all mild untreated glaucomas, i.e., in those with quite moderate tension; also in eyes which had been under treatment by miotics, but in which the treatment was becoming ineffectual.

The failures have occurred in the more advanced glaucomas with considerable tension, though in such eyes there have been also many excellent results. We hope shortly to make an attempt to follow up some of the older cases again. But it may be stated generally that the harder the eye, and the longer the hardness has lasted, the greater is the tendency to firm healing, or to leakage only through undesirable fistulous openings.

These are precisely the eyes which furnish the more troublesome temporary recurrences of tension after wide iris-prolapse operation (see *Trans. Ophthal. Soc. U.K.*, 1919, and *Brit. Jl. of Ophthal.*, May, 1920). In primary glaucoma there seem to be practically no permanent failures after this prolapse operation; and even no troublesome transient recurrences in the milder and earlier glaucomas. The temporary failures by this method correspond with the permanent failures of other operations. The two must have the same cause. Since the cause of the transient return of tension must obviously be some temporary condition, this same

* This paper embodies remarks made at the last Oxford Ophthalmological Congress.

temporary condition must account also for the permanent failure of such operations as flap sclerotomy, performed on these high-grade advanced glaucomas. The only transient condition which seems capable of explaining the recurrence peculiar to this group of glaucomas, is a relatively highly albuminous aqueous from the sudden great fall from high-grade plus tension to a definitely subnormal tension for a time.

However, the explanation is of quite secondary importance. Whatever the condition may be, it evidently tends towards firm permanent healing of an iris-free wound, though it does not prevent filtration developing later through a fold of prolapsed iris.

The important observation was made that some of the very advanced untreated Indian glaucomas, which gave protracted recurrences of tension, had been readily reducible by eserin before operation. It is a fair deduction that in these eyes recurrence could have been prevented by keeping the tension normal for a sufficient period beforehand. The special liability to return of tension would have been removed, and the eyes would have been rendered suitable for flap sclerotomy. Thus the group of eyes in which, as shown by experience, we may expect certain and complete success from flap sclerotomy, is evidently susceptible of some enlargement by preparatory miotic treatment.

Thus the broad division of glaucoma into two main groups, according to completeness or incompleteness of response to miotics acquires practical significance.

It may be a sound practical rule to utilize rectangular flap sclerotomy *only where eserin acts well, and only after preparatory miotic treatment* lasting two to six weeks, according to the degree and probable duration of the previous (continuous) plus tension. At least we can thus restrict the application of the method to cases in which we may confidently expect always complete success.

There is still some doubt regarding the permanency of reduction by iris-free filtering cicatrices generally. I have lately had to operate again on the two eyes of a medical man which had been satisfactorily relieved by wedge-isolation operations performed in 1909. And Mr. Laws has lately had to operate a second time on a buphthalmic eye for return of tension after a flap sclerotomy performed, like the above, in 1909.

This doubt may be appreciably lessened by the above preparatory miotic treatment. The freer filtration obtainable by thus reducing to a minimum the condition which makes for firm healing, must tend towards permanency.

I do not know of any other operation which provides with certainty an equally good filtering cicatrix with so little trouble or risk, or disturbance of the eye. And even if one were mistaken as regards the infallibility of the method in these selected cases, the

need for a rare repetition of this small operation would not be a very serious matter. See the case reported below.

Possibly equally as important as the eserin beforehand is the free use of atropin after operation, continued as long as any congestion of the eye remains. An attempt may be made by repeated instillations to dilate the pupil on the first evening or even earlier if, as not infrequently happens, an irido-dialysis has been produced. The practice is based on the old observation that the average results of iridectomy were better in the glaucomas with high-grade tension. Any tendency to immediate recurrence of tension, whether brought about by atropin or not, should have a greater effect in opening up the wound if it be a rectangular flap incision, than if it be an ordinary iridectomy wound.

In a few very advanced glaucomas, readily controlled by eserin, I have preferred iris prolapse operation to flap sclerotomy. These have been eyes with considerably impaired central vision, and with the fellow eye blind or nearly so. In such cases the drawbacks of the (moderate) astigmatism and of the somewhat enlarged pupil of the prolapse operation, are negligible. In these cases it is of supreme importance that the permanence of the relief of tension should be as nearly absolute as possible; the slightest further deterioration of vision might have a crippling effect.

A case was shown at Oxford—one of the very few eyes upon which I have repeated a flap sclerotomy. The tension two months before the first operation only measured 47 Schiötz, but the eye did not respond well to eserin. One daily instillation of ¼ per cent. solution reduced the tension partly, but under three instillations daily the tension rose again. The case, therefore, did not fall into the group most suitable for flap sclerotomy, as above defined, though the tension was never very great. The first operation in August, 1911, only lowered the tension to an average of 37, the same effect as was got from one daily instillation of eserin. The second flap sclerotomy, however, performed in May, 1912, produced a lasting fall in tension; two recent measurements gave 19 and 25. The eye shows typical scars; those of the first operation are faintly coloured with uveal pigment, revealing some adhesion of the iris to the scar, which, however, is not visible. I think this adhesion of iris may have been largely responsible for the insufficiency of the first result, though such a trace of iris pigment is frequently seen in the scars of successful cases.

The fellow eye, with Schiötz tension 37 when first seen, has been treated satisfactorily by one daily instillation of eserin till lately, when this became ineffectual. As with the first eye, an increase in frequency of the drops to three times daily raised the tension from 40 to 60. So a prolapse operation was performed on June 9th, this year.

The operation is still performed as described in 1910, with the 3·5 mm. bent broad needle for the end cut, and the trowel-handled narrow knife for the side cuts. Both need to be sharp, particularly the latter. A number of modifications have been tried, but none of them have given improved results.

I personally like to extend the lateral incisions rather far into the deeper layers of the cornea, with the idea of thereby increasing the shrinkage of the flap. Probably this shinkage accounts for the fact that in our hands the knife operation has given better results than those got by cutting a somewhat similar flap with Bishop Harman's twin-scissors.

The flap need not be strictly rectangular. And to lessen the possibility of pressure of the narrow knife on the lens in the sawing movements, the cutting edge may be conveniently directed forwards and inwards for the inner incision, and forwards and outwards for the outer incision. Also a quite short flap has often served fully as well as the longer flaps. (I can remember injuring the lens only in one of these operations. Posterior stellate cataract formed early and ripened rapidly. The flap was a long one. The fellow eye was operated upon at the same time with a shorter flap, without trouble of any kind.)

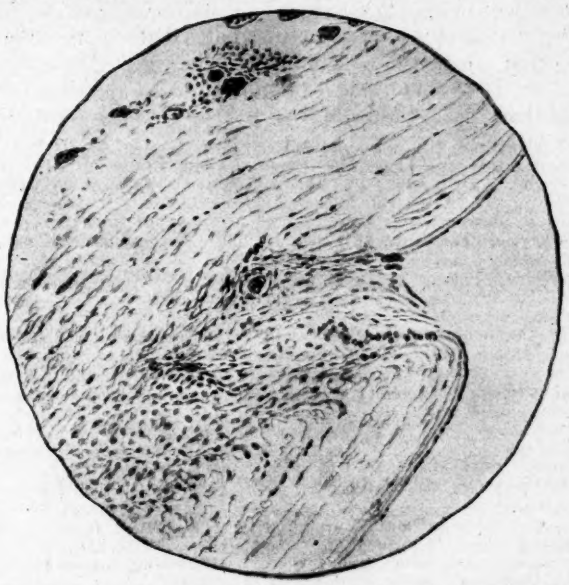
Some surgeons are still inclined to question the existence of the strictly filtrating cicatrix, thinking that the leakage may be always through fistulous openings, possibly microscopic. The illustration on next page is from a section of an eye excised for recurrent

tension two weeks after the performance of rectangular flap sclerotomy; the section was kindly given to me years ago by Mr. Greeves.

Filtration was shown by "quite a good area of oedematous conjunctiva." But the filtration was insufficient; and one knows now that the moderate flow which takes place through the typical filtering cicatrix could not possibly have been sufficient to relieve the tension in this eye. It was a case of very advanced secondary glaucoma, with filtration angle obliterated by firm union.

Mr. Greeves made serial sections showing that the gap at the end of the flap was everywhere fully occupied by new fibro-cellular tissue. I have little doubt that in this case the tissue would ultimately have become further organised into a dense impermeable scar. But in its present filtering stage it serves fairly well to illustrate the final condition of the scars which are found clinically to filter permanently and satisfactorily.

It is no more strange that, bathed in aqueous, the healing process should remain permanently incomplete after these operations, than that it should fail altogether in the centre of a trephine hole. It would be strange indeed if, in not grossly dissimilar cases, there were only the two extremes—complete failure on one hand, and firm union on the other—with no connecting links.



It is perfectly obvious clinically that the tissue composing the filtering grey lines is quite different from that which causes the disappearance of a fully healed scleral wound. (Ordinarily it is impossible to locate soundly healed scleral wounds).

Further, I do not believe there is ever a leaking hole in a scleral scar, which does not give clinical evidence of its existence. Where the leakage is least there is always a dark point to be seen. The clear conjunctiva over it is, perhaps, slightly elevated; and, particularly in the pigmented Indian eye, there is some washing away of pigment from this covering conjunctiva, and a tendency to accumulation of pigment in the form of an imperfect ring at a little distance around the opening.

There are other larger fistulous openings which cannot be seen, because the flow of aqueous is so free as to alter the minute anatomy of the (swollen, oedematous) overlying conjunctiva sufficiently to make the conjunctiva opaque, whitish. Whenever this opacity is marked, one must admit at least the probability of a fistulous track beneath.

The serious practical question arises: with our present knowledge, particularly as considered above, is it any longer fair to the patient deliberately to aim at the formation of a sclero-corneal fistula, in treating a glaucoma which can be relieved with certainty by the truly filtering cicatrix of a flap sclerotomy? Is not one incurring an entirely unnecessary risk of late infection, for a very doubtful advantage in the matter of assured permanency of filtration? The question is a large one; but there is much pertinent material now available for collation. And there seems to be a growing feeling against acceptance of late infections as inevitable. I personally believe the liability to the severer grades of late infection will be almost entirely eliminated from glaucoma operations.

In the milder glaucomas the problem of prevention appears to be adequately met by such procedures as flap sclerotomy. Not only must the conjunctival changes be reduced to a minimum, but, knowing that virulent organisms can penetrate beyond the normal conjunctival epithelium, we cannot afford to dispense with the available thick living filter in the sclero-corneal wound, shown in the illustration.

The infective danger.—I have never known of a late infection after flap sclerotomy, though such may possibly have occurred in advanced glaucomas where relief has been obtained by a partly fistulous scar. The case of possible ectogenous infection through an apparently unexceptionable scar, reported in the *Ophthalmoscope*, 1914, p. 5, warns one to be cautious in one's expectations; but in this case the inflammation was not severe, the operation was wedge sclerotomy, and one has no definite knowledge of the anatomy of the cicatrices produced by this operation. With the suggested restriction of the use of flap sclerotomy, one may fairly assume that the method gives practical immunity from risk of massive infection.

One must beware of connecting particular operations necessarily and exclusively with certain types of scar. Take, for instance, trephining as practised by Col. Elliot. In the milder glaucomas now particularly considered, only a section of the disc is removed, particularly of the deeper layers, and much of the trephine hole is covered by a lid of impermeable corneal tissue. (It does not seem clear that this superficial covering of corneal tissue ever becomes permeable to aqueous. The gradual extension of a conjunctival thickening over the cornea, like the growth of a pterygium, is seen with any fistulous track close to the limbus. In the conditions of this sort which I have seen from other operations, the dark leaking point under the conjunctiva has remained always unaltered in size). The result is that there is an oblique track made between a slit-like opening below and a similar one above. The narrower the slit the more likely is it to become bridged by new tissue, such as shown in the above illustration; and doubtless the moderate leakage through such a truly filtering scar is ample for some glaucomas, for a time at least, though the slit is so short.

But the points to consider are: (1) That attempts to graduate the flow of aqueous in accordance with one's estimate of the needs of individual cases, by altering the size and shape of sclero-corneal openings, seem to have been rewarded with but indifferent success. Hence the hypotonies, the bleb-like cicatrices and the septic disasters, which have occurred even in the best eyes—those eyes least prone to such troubles, and most easily relieved by true filtration.

And (2) though punch operations and trephinings have produced many "flat cicatrices," yet these are the operations least designed to afford the full available protection. They are the procedures most calculated to form definitely open sclero-corneal tracks, imperfectly protected. The more the flow of aqueous is narrowed to a point, the freer must be the sclero-corneal canal for any given quantity of fluid to pass; and the nearer the point is to the adherent limbus, the greater is the tendency to direct forward passage through the conjunctiva. What is needed, on the contrary, is an extended line of filtering scar tissue under the loose conjunctiva away from the limbus.

Permanency of relief of tension. In attempting to check a progressive disease or tendency by an outlet of limited capacity, one must feel apprehensive lest the limit of the relief provided be reached sooner or later, unless immediate needs are considerably oversupplied. Unless there were some elasticity in the means provided for relief, more or less immediate hypotony must be a necessary accompaniment of any but quite temporary operative relief of glaucoma. Evidently these filters are not ordinarily called upon to work at once at their full capacity; some elasticity in action must be admitted (see *Trans. Ophth. Soc. U.K.*, Vol. XXXIX [1919], pp. 227-8).

Also it seems clear that the fundamental changes responsible for the tendency to plus tension—the predisposing causes of glaucoma—commonly progress very slowly indeed. Otherwise the results of the more moderate filtration operations would be much less durable than they have proved to be. Evidently these operations must act largely by breaking the vicious circle. The most important element in the advance of untreated glaucoma seems to be the high tension itself, as seen in its effect on the filtration angle, and possibly otherwise.

But the practical question of permanence is one to be settled by experience only. One must distinguish between quite early returns of tension (really primary failures to relieve tension satisfactorily) and late recurrence after years. The only examples of the latter known to me, following small flap sclerotomy, or wedge sclerotomy are those mentioned above; but doubtless there must have been others, more particularly in cases which one is inclined now to class as unsuited for sclerotomy.

Here again, as in considering late infection, it is a question of the type of scar produced, rather than of particular operations.

And it may yet prove to be of no small advantage altogether to escape hypotony in providing relief by means of the strictly filtering cicatrix.

The three late failures above mentioned have as yet meant little more than the necessity for supplementary operations. In two of the eyes ample warning was given by the appearance of haloes around lights; and the third eye is still a useful organ.

THE GOVERNMENT OPHTHALMIC HOSPITAL, MADRAS

BY

NORMAN B. B. FLEMING,

LONDON.

DURING the autumn of 1919, I had the pleasure and privilege of attending the great eye clinic at the Government Ophthalmic Hospital, Madras. Several others, who have had similar good fortune, have recorded their experience with details of the hospital, its buildings, methods and administration, and a repetition of this from me would, I think, be superfluous; nevertheless, many things have changed and many further improvements been accomplished recently under the able guidance of Colonel Kirkpatrick, who succeeded Colonel Elliot as superintendent, and a few notes of my impressions may be of interest.

The new infectious block is now in full running order; it is a two-storey building equipped on similar lines to the rest of the hospital and possesses a large theatre provided with two operating tables which are placed each alongside a large window. The pathological department is much more fully equipped and possesses a wealth of interesting material; Wassermann test and cultures are still made at the King Institute, a very large and up-to-date

pathological and bacteriological laboratory, presided over by Major Cunningham, who very kindly took me through the Institute and showed me the methods of wholesale vaccine manufacture which he employs there; all other forms of work are done in the hospital laboratory.

The Elliot School of Ophthalmology, in connection with the hospital, was nearing completion when I was there, and I have since heard that it is already in use. It consists of a very large dark room with many cubicles, each equipped with an electric ophthalmoscope and filament lamp, also a theatre fitted for demonstration purposes, a museum, and another dark room for photography.

The routine and efficiency of the subordinate staff, all of whom, with the exception of a few nurses, are Indians, is very remarkable; of this fact the phenomenal amount of work successfully performed bears sufficient testimony.

Two days per week are devoted to intra-ocular operations, one to extra-ocular, and three to the inspection of post-operation cases and dark room work, each day being completed by examining the more important of the external diseases occurring among the out-patients, and a visit to the laboratory.

Certain points in the method of cataract extraction favoured there impressed me. The method of bandaging was to me quite new in practice, though I had seen it described and figured in "Sclero-corneal Trephining."* A linen bandage is put on in what might be described as the "ready" position, before the operation is commenced; it passes round the back of the head, and is provided with a slit on either side for each ear; after the operation the two free ends are folded over the eyes, one passing through a slit in the other and pinned over either temple; two thin strips of the bandage are tied above the head, and two others under the chin. This bandage has the advantage of making the slightest movement of the head quite unnecessary during adjustment, and also it is not easily removed by the wearer—a matter of immense importance in India. The screw of a stop speculum is never used; in fact, it is removed as unnecessary and dangerous. The capsule is opened with a Bowman's needle before the section is made; a T-shaped incision is the rule, the entering needle being half turned to make the horizontal limb, again half-turned to make the vertical limb, and then withdrawn. A corneo-scleral section is always aimed at. The iridectomy is performed with straight scissors. The following manoeuvre is, I think, of great importance and value: for expression, one curette only is used; by means of a little judicious coaxing movement the lens is pushed down from above with one end, and then, with the other, pressure is applied in the ordinary

* R. H. Elliot, 1914, pp. 51-52.

way on the lower part of the cornea; the lens glides out without the slightest tendency to pass up and catch in the upper angle.

Irrigation is a routine. It is worked by an assistant from a large flask fitted with two tubes and a rubber bulb, on McKeown's system; a slightly curved—not bent—nozzle is employed, but this is never permitted to enter the wound.

If the patient is at all troublesome a Smith's hook is used during iridectomy, expression, and irrigation. While the operation is proceeding it is distinctly the exception for any instructions to be given to the patient, but quite the rule for a lively conversation on the patient's family-history to be carried on in Tamil or Telegu between him and one of the peons.

I was much interested to see the number of cases of excision of the tarsal plate for old standing trachoma, and the success which followed the procedure. In examining slides of the specimens obtained I was struck by the frequency with which I found isolated portions of the lacrymal gland embedded in the tarsal plates.

In the after treatment of intra-ocular operations the instillation of weak silver nitrate drops is a very favourite and apparently valuable practice; the instillation causes no pain whatever.

The method of illumination practised both for operating and for subsequent examination was recently described by Colonel Kirkpatrick in a letter to the *British Journal of Ophthalmology*. It would be difficult to over-estimate its efficacy.

Two points of treatment are, I think, worthy of note; one is the use of picric acid drops in vesicular conditions of the cornea and another an eye bath of saturated magnesium sulphate in sloughing corneal ulcers.

I was particularly fortunate in seeing a large number of cases of the epidemic keratitis described by Colonel Kirkpatrick in the *British Journal of Ophthalmology* of January, 1920, and also the methods by which he endeavoured to elucidate and treat this peculiarly interesting condition.

ANNOTATIONS

Trout and Tar Poisoning

That trout have totally disappeared from a number of English streams since the war is a fact widely known and puzzling, at all events to fishermen. What is the reason? The popular theory until recently has been that it was due to the contamination of the water with tar products from neighbouring roads and by refuse from

works. To this view a suggestive communication by Messrs. M. S. Mayou and H. Neame dealing with the "late effects of tar poisoning on fish," to be found in another column, furnishes interesting evidence. From a certain Hampshire trout stream, the waters of which had been contaminated from tar used upon the road, fish were taken out in large numbers, dead, dying, and blind. Tar obtained from the road was used for experiments upon fish in ponds, and it was found that the phenol constituents of the tar caused the same effect upon the fish in the pond as upon the fish in the stream. Messrs. Mayou and Neame give a description of the eyes, microscopic and otherwise, of a semi-blinded trout removed from the stream. The question of tar pollution and its effects upon fish is at the present moment under consideration of a joint committee appointed by the Board of Agriculture and Fisheries and the Ministry of Transport. While the foregoing theory has held the field until recently, an attempt has now been made to replace it by another, namely, the multiplication in the streams of pike. A sort of drive was organized over certain reaches of the River Lea, and a surprising number of pike bolted from the weeds. It is possible, then, that this factor, together with the neglect of the rivers which has been general since the war, is a cause of the disappearance of the trout. The statement was made only the other day, however, by a responsible writer in the public Press that "trout have practically disappeared from many a stream where pike do not exist." The writer offered to give instances. But the theory of poisoning by coal-tar effluents (for which there is some good evidence) cannot be dismissed lightly. The presence of pike would doubtless account for the disappearance of trout, but could scarcely be held responsible for the blinding of those fish.

A New Ophthalmological Society

The inaugural meeting of the South-Western Ophthalmological Society was held on October 22nd last at the Bristol Eye Hospital. The new Society, of which it is hoped to hold about three meetings a year, already numbers fifty members. It is intended to meet the convenience of the south-western area of England, including Wales, a district that embraces several large towns, notably Bristol, Bath, Cardiff, Plymouth, Cheltenham, and Newport. The first meeting was attended by some thirty members, or three-fifths of the whole, a sign of the excellent spirit that actuates the new-comers, and we trust may continue to do so. About thirty cases were shown and discussed. After lunch at the Grand Hotel, a business meeting was held, when Mr. Richardson Cross was elected president, Messrs. A. C. Roper and R. J. Coulter vice-presidents,

Mr. E. H. E. Stack secretary and treasurer, and the following members of committee; H. H. Du Boulay (Weymouth), J. Burdon-Cooper (Bath), C. E. S. Fleming (Bradford-on-Avon), A. W. Prichard (Bristol), D. Leighton Davies (Cardiff), and R. Jaques (Plymouth). A discussion, which excited animated controversy, upon "The causes of Iritis," was opened by Mr. A. C. Roper. In the afternoon Mr. Richardson Cross, in summing up the objects of the Society, pointed out the necessity of keeping the discussions upon broad lines, so as to be of interest not only to the ophthalmic surgeon but also to physicians and general practitioners, of whom a number were present at the meeting.

AUSTRALASIAN MEDICAL CONGRESS, 1920.

Section of Ophthalmology.

At the Australasian Medical Congress held in Brisbane, Australia, in August, 1920, very useful work was done in the section of ophthalmology. The presidential address was delivered by Dr. A. L. Kenny, who dealt with the repeated attempts made by opticians to secure legal registration as sight testers. The section would assist the opticians in any efforts made to secure a better education in their craft, but refused to have anything to do with the legal recognition of sight-testing on the part of people who had not received a medical education. The decision was endorsed by Congress as a whole.

An interesting discussion on iritis was opened by Dr. Halliday, of Sydney, who gave a judicial summary of the present attitude.

Sir James Barrett agreed with Dr. Lindo Ferguson's classification of iritis so far as causation was concerned. He thought that approximately a third of the cases was syphilitic in origin and that about half the cases corresponded to a clinical type usually called rheumatic. There was no evidence that these cases had anything to do with rheumatism but there was abundant evidence that they were powerfully influenced by the exhibition of salicylates. He thought it desirable to retain the term rheumatoid iritis because everyone knew what it meant. Of the remaining cases a number might be due to to septic foci, pyorrhoea and the like, but he must confess to a sceptical attitude; tens of thousands of people had septic foci and did not get iritis.

Dr. Lockhart Gibson said that he had always found by far the majority of iritis cases to be either what he still calls rheumatic, or syphilitic. He was not wedded to the term rheumatic except for expressing a variety of iritis which he expects to get well if treated in the acute stage with treatment supposed to be specific for acute rheumatism. He had always put such cases in bed, and given them 20

grains of sodium salicylate every two hours night and day. It practically prevents disagreeable symptoms from the salicylate. Atropin is the only local treatment he uses, 1/200 grain, four hourly, more or less. He expects an acute case with posterior synechiae and occluded pupil to show a dilated pupil and greatly improved sight in 30 hours. The doses are continued either two hourly or four hourly according to the case. If they are reduced too soon they must again be increased. Latterly of course he has paid attention also to possible local infection as a cause, but in the past he has never failed to get such cases well, if seen in the acute stage, without reference to the teeth or tonsils. The treatment is as specific for so-called rheumatic cases as mercurial inunction is for syphilitic ones, but the doses must be as large as he gives. He did not deny the possibility of these large doses acting through disinfection of the alimentary or genito-urinary tract.

Sir James Barrett opened a discussion on the subject of Visual Standards that should be required for military recruits. He pointed out that thousands of men had been rejected owing to the imposition of a standard of visual acuity which was, in his opinion, unnecessarily high. It had been found in Egypt that vision of six twenty-fourths in the right eye, provided that the left eye was not blind, was sufficiently good for most purposes. He thought that the fixation of high standards was due to a misapprehension. In the case of sailors and railway men visual acuity of less than six-twelfths involved secondary colour blindness, which was a very serious matter, but the rank and file of an army did not need to possess good colour vision. He accordingly recommended that the standard of vision be fixed at six-eighteenths in the right eye provided that the left eye was not blind: blindness being defined as inability to count fingers at three feet distance, or if shooting be permitted from the left shoulder vision of six-eighteenths in either eye provided always that there was no progressive disease in the better eye. This visual acuity might be obtained with or without glasses, and it seemed to him that it did not matter what a man saw without glasses. The Army Council at the end of the war had fixed this standard of vision for motor drivers but without glasses, so that it was quite evident that the standard was sufficiently high. For "B" class men he suggested vision of six thirty-sixths in one eye. For officers he recommended the retention of the Army Council standard of April 2, 1918. For commision in the Royal Air Force the standard laid down by the Army Council, 1917, and for the Tank Corps the standard fixed towards the conclusion of the war. The recommendation was unanimously endorsed by the section after discussion, agreed to by the Congress as a whole, and was ordered to be submitted to the Government of the Commonwealth for its consideration.

Dr. Lockhart Gibson gave a convincing demonstration of optic neuritis in children due to lead poisoning. The houses in Queensland are built on piles on account of the white ant trouble; the children play on the verandahs which are elevated a long way from the ground, the sun pulverises the white paint on the verandahs and from the hands of the children the paint gets into the mouth. Some criticism was expressed respecting the theory, but as optic neuritis in children is very rare in Southern Australia, and is quite common in Brisbane, and as some of the children have the blue line on the gums, the general opinion was that the case was proved; furthermore, when de-ionization was effected by passing a current through the body from hands to feet, lead was found on the negative pole. The remedy suggested is to substitute zinc for lead as a basis for the paints.

Dr. E. O. Marks exhibited an ingenious and effective large-scale scotometer, which was provided with a self-recording apparatus.

ABSTRACTS

I.—OPHTHALMOSCOPY IN RED-FREE LIGHT

(1) **Heine, L. (Kiel).—On ophthalmoscopy in white and coloured light. (Ueber Ophthalmoskopie in weissem und farbigem Lichte.)** *Arch. f. Ophthal.*, Vol. XCVII, 1918.

(2) **Vogt, Alfred (Basel).—On the technique of ophthalmoscopy in red-free light. (Zur Technik der Ophthalmoskopie im rot-freien Licht.)** *Arch. f. Ophthal.*, Vol. XCVIX, 1919.

The work of Vogt and Affolter (*vide* review in the BRITISH JOURNAL OF OPHTHALMOLOGY, 1918, p. 248) has induced **Heine** to contribute this short paper on the subject of Sources of Light for Ophthalmoscopy.

The use of a spectrum is, in his opinion, more valuable than any other form of red-free light, because by it one can examine the fundus in any colour that may be desired. He comments on the clearness with which the minutest changes in the retinal vessels, as well as the reflexes described and illustrated by Affolter, can be observed with the green light from this source.

He finds, however, that for the diagnosis of commencing optic atrophy, this monochromatic light is not so useful as the yellowish-red light from a carbon filament lamp, or daylight, or arc lamp with matt blue glass.

As regards the debated question of the yellow colour of the macula, Heine states, in striking contrast to the findings of Vogt

and Affolter, that he has nowhere observed it either in normal or pathological conditions. He also takes objection to the breadth of the light reflex on the retinal vessels and the colour of the optic disc, as shown in the plates illustrating Affolter's article.

The apparatus which **Vogt** recommends for making ophthalmoscopic examination in red-free light, consists of a filter, containing copper sulphate and erioviridin in fixed solution, and a Zeiss lens, which are placed in a wooden box painted black on the inside: behind them a small arc lamp is set so that the centre of the crater lies in the axis of the lens and just within its focal point. The rays of light issuing from the lens are then slightly divergent.

Convergent rays are, however, useful in the examination of opacities or foreign bodies in the vitreous, a highly hypermetropic fundus, or the dome of an intraocular tumour or retinal detachment. The best amount of convergence is then easily ascertained by moving the crater slightly behind the focal point of the lens.

The relative position of the lamp and the patient's head is important. The centre of the bundle of light issuing from the box should fall on the outer canthus of the eye to be examined. It is therefore necessary to have the patient's head fixed in one position by the examiner's free hand, or an attendant, or with the help of a chin-rest.

Before commencing the examination, care should be taken that the cross section of the light bundle from the lamp forms a circle (as seen by holding up a sheet of paper before it), otherwise the carbons are not in proper position.

It is important that the centre of the light, i.e., the image of the crater, be reflected into the fundus. The area of the retina thus illuminated appears green or pale greenish-yellow; round the edge it is, in consequence of chromatic aberration, slightly more yellow. To determine a yellow tone in the fundus, one should therefore judge by the central portion, not the periphery, of the light. If the weak peripheral yellow zone of the light were reflected from the ophthalmoscope into the eye, the whole fundus would appear yellow, and in this way the yellow colour of the macula would readily be missed. Vogt points out that it is due to the insufficient intensity of light that one fails to see the yellow macula with the mercury vapour lamp.

He refers to several points in Heine's article, and suggests that the difference in the findings of Affolter and Heine may be partly due to a difference in the source of light, but more so to a difference in the intensity of the light employed.

THOS. SNOWBALL.

II.—AGE AND STATIC REFRACTION OF THE EYE

Landolt, E. (Paris).—The influence of age on the static refraction of the eye. (L'influence de l'age sur la réfraction statique de l'oeil.) *Arch. d'Ophtal.*, Jan.-Feb., 1918.

After referring to the work of Donders concerning the refraction of the eye, both static and dynamic, **Landolt** discusses the changes which may occur in later life in the static refraction. In a state of rest, is the static refraction of every eye less in old age than in youth? Donders showed that this is so, and there is no doubt that in the large majority of cases his findings are correct. But it is equally true that there are exceptions to the rule; the static refraction instead of being diminished may undergo augmentation with advancing years.

Landolt cites two cases: (1) an emmetrope who having become presbyopic about 50, developed myopia, reaching 6 D. in amount, by the time he was 70, and required a concave lens of 3 D. in order to see distinctly at 30 c.m.; (2) a hypermetrope of 3 dioptres who became emmetropic in the same number of years.

Examples of this kind are familiar to most ophthalmologists. Such alteration in static refraction is clearly not due to an elongation of the eyeball, but is attributable to an increase in refractive power; it is more than probable that the change to which this increase is due occurs in the lens. There is evidence to favour the view that an alteration in the index of refraction of the lens takes place in these cases, and that this, rather than any modification in the shape of the lens, is responsible for its greater refractive power.

Accompanying such changes in the lens of old age, there are frequently slight alterations in its colour and some loss of transparency; as a clinical manifestation in addition to the altered range of vision, a halo showing more or less colour, is often noticed around points of light at night.

It may be stated, as a general rule, that when the static refraction of the eye becomes augmented, as in the case quoted (by reason of an increased refractive power and not from elongation of the globe), the retinal images are reduced in size and consequently the visual acuity is lowered.

An emmetrope who has an acquired myopia of 3 dioptres, requires a concave lens of 3 D. to enable him to see the usual test types. This lens being in front of the anterior focal plane of the eye reduces the size of the retinal images, and the man is unable to distinguish small types which he could read with the unaided eye during the stage of emmetropia. It is not difficult to adduce proof of this. If a young emmetrope looks through a concave lens, placed in the usual position of a spectacle lens, objects will appear smaller than to his

naked eye. The accommodation necessary to neutralize the concave glass has produced a myopia comparable to that which certain eyes acquire in old age. If the old patient with acquired myopia shows a visual acuity less than he had ten years previously, it is not proof that his *physiological* acuteness of sight, i.e., the perception of images of the retina, has become less. The lowered acuity is a result of the diminution in the size of the retinal images by the lens which corrects the acquired myopia. On the other hand, although he has the advantage of his contemporaries, who remain emmetropic, and are presbyopic, in his power to read without glasses, his near vision, other things being equal, is not as good as theirs with their convex and magnifying lenses. An *axial* myope of the same degree and with equal visual acuity for distance, will always see minute objects, near at hand, better than he does, in consequence of the larger images formed on the retina of an elongated eye.

The writer concludes by stating: If Donders' law, according to which dynamic refraction (accommodation) diminishes gradually as age advances is constant; his law concerning static refraction admits certain exceptions. Instead of diminution static refraction may undergo augmentation; and if this be true, the greater is the probability that it will generally remain stationary.

J. B. LAWFORD.

III.—RETINAL ADAPTATION

(1) **Behr (Kiel).—The behaviour and diagnostic significance of dark adaptation in the various diseases of the optic nerve trunk. Part I.—Dark adaptation in optic neuritis and papilloedema. (Das Verhalten und die diagnostische Bedeutung der Dunkeladaptation bei den verschiedenen Erkrankungen des Sehnervenstammes. I. Teil.—Die Dunkeladaptation bei der neuritis optici und der Stauungspapille.) Part II.—The atrophic conditions of the optic nerve. (II. Teil.—Die atrophischen Zustände des Sehnerven.)** *Klin. Monatsbl. f. Augenheilk.*, October-November, 1915, p. 193. November-December, p. 449.

(1) **Behr** has studied the alterations in dark adaptation which occur in diseases of the optic nerve, and has found that the presence or absence of such changes is of value in diagnosis in affections of the basal visual path, as well as in diseases of the choroid and retina. Piper's apparatus was used, which consists of a constant source of light, a variable diaphragm, and a plate of

milk glass. The patients were taken from diffuse daylight to a dark room, and observations were made every five minutes. The diaphragm is opened until the light is perceived, each eye being tested separately, and the smallest perceptible amount of light recorded. The maximum diaphragm opening corresponds to 10,000 "light units" (0·06 metre-candles [*Meterkerzen*]), and the light can be reduced to less than 1 "unit," or 0·000006 metre candles. Reciprocally, these amounts correspond to 1 and more than 8,764 units of retinal sensitivity respectively, the minimal diaphragm opening being equal to 40,000 retinal units. A scale gives intermediate values. By a combination of adaptometer and perimeter, different parts of the retina may be examined.

Normally adaptation begins slowly, then rises rapidly, and finally increases very slowly until the maximum is reached in about 45 minutes. The maximum may vary greatly, but should be equal in the two eyes. Pathologically, two kinds of change may occur. The shape of the curve may be altered by the absence of the phase of rapid increase. The rise is slow and even, and the maximum is reached early. Secondly, the maximum may be altered. Behr's experience is that values under 1,500 (units of retinal sensitivity) are suspicious, and those of under 1,000 are certainly pathological. In certain circumstances, for instance where there is a considerable difference between the two eyes, a value of 2,000 or more may be regarded as pathological. The theory of dark adaptation and the parts played by the rods, cones, and visual purple are shortly discussed, and the author emphasises the point that his researches are not to be interpreted as an attempt to elucidate these questions. It is also important to remember that dark adaptation is not a process solely confined to the retina, but is reflexly regulated by nervous centres. This circumstance may afford an explanation of the fact that dark adaptation and the other visual functions often react to disease in opposite ways. Great reduction of central vision, of colour vision, and of the visual field may be associated with normal or relatively less reduced dark adaptation. These considerations have led Behr to the following conclusion: "All processes mechanically affecting the optic nerves and basal visual paths (tumours, haemorrhages, trauma, papilloedema, hydrocephalus internus, etc.) influence central vision, colour vision, and the field of vision more than dark adaptation. On the other hand, inflammatory, and especially chronic degenerative processes strongly reduce dark adaptation, while the other visual functions are affected either not at all or very much less." An exception to this rule occurs in cases in which changes are present in the retina and choroid as well as in the optic nerves. In such cases the behaviour of dark adaptation is uncertain. Since alterations in the earlier part of the adaptation curve depend on the previous exposure of

the eye to light, it is sufficient for practical purposes to examine the dark adaptation after forty-five minutes.

The author proceeds to give an account of six cases of inflammation of the optic nerve. They all showed reduction of dark adaptation during the acute stage and recovery during the subsidence of the inflammation. It is claimed that this sign is of value in diagnosing cases in which there is "ophthalmoscopically a well marked picture of optic neuritis with normal vision, normal field of vision and colour-vision and normal pupillary light reaction," and is more reliable than the vision in giving an indication of commencing resolution. In the slightest cases changes in dark adaptation form the sole and most delicate reaction to the inflammatory process. This examination is also valuable in the diagnosis of pseudo-neuritis, and in the differentiation of visual defects due to injury of the optic nerve from those due to inflammatory conditions.

Behr cannot agree with Uhthoff's view that papilloedema may be diagnosed if there is a prominence of the nerve head of 2 D. or more. Disturbance of dark adaptation is not altered or only very little in papilloedema and may even be normal in atrophy following papilloedema with reduction of vision and extensive alterations in the fields. The fibres which subserve the reflex mechanism of dark adaptation are much more resistant to mechanical influences such as pressure than the visual fibres. In extreme cases of this kind vision may be reduced to the perception of fingers close to the eyes and the field to a small excentric remainder without the slighest disturbance of dark adaptation.

The second part of the paper deals with the behaviour of dark adaptation in various forms of atrophy. In those cases this test often affords the only evidence as to whether the primary condition is inflammatory. It may, however, fail where a considerable time has elapsed between the commencement of the inflammation and the appearance of the atrophy, as during the interval, the acute stage and with it the disturbance of dark adaptation both pass off. The absence of reduction of dark adaptation in Leber's atrophy indicates that this is a non-inflammatory condition. This part of the paper is not very easy to follow but the author's view seems to be that in simple descending atrophies dark adaptation is not disturbed or not seriously disturbed unless there is an inflammatory or toxic origin, and then only while the inflammation or intoxication is active. In progressive atrophy, on the other hand, of which tabetic atrophy is the prototype, dark adaptation is very markedly affected often before even the slightest changes can be detected in central vision, colour vision, or the fields. This is explained on the ground that the atrophy is due to the toxic products of spirochaetes present in the optic nerves.

The author's investigations have led him to divide the progress

of tabetic atrophy into four phases: 1. Isolated disturbance of dark adaptation; Ophthalmoscopic appearances and functions otherwise normal. 2. Disturbance of adaptation, plus visible atrophy, other functions normal. 3. Disturbance of adaptation, visible atrophy, reduced central vision and colour vision and defects in fields. 4. Blindness.

The patients themselves appear to be unaware of the loss of adaptation and even state that they see better in dim light. This is because the amounts of light dealt with by Piper's adaptometer are far below those which occur in ordinary experience.

Though in parts a little difficult to follow and probably affording room for some controversy, Behr's paper is full of interest. His further investigations and the confirmation of his results by others will be looked forward to by ophthalmologists.

H. M. TRAQUAIR.

(2) **Downey, Jesse Wright (Baltimore).—Determination of minimal light sense and retinal dark adaptation, with presentation of a new type of photometer.** With three illustrations. *Amer. Jl. of Ophthal.*, January, 1919.

(2) **Downey,** in an article of some length, deals with the question of visual sensation in regard to light and dark adaptation of the retina, and describes a type of photometer he has invented, in which he makes use of a radio-active substance as a standard of comparison.

First, he goes into the physiology of the visual process, all visual sensations being dependent on the power which the retina possesses of adapting itself to light variations of varying intensity, and of converting them into nerve stimuli.

The simplest example of light and dark adaptation of the retina is obtained when we pass from bright sunlight into a dimly lighted room, objects in the room being obscure until our eyes become accustomed to the dark; and conversely, when we pass from a dark room into sunlight we are dazzled for a time. The process of adaptation to different intensities of light depends on alterations that take place in the nerve cells of the retina leading to stimulation of neuro-visual consciousness. Our consciousness of light sensation may be divided into two classes, viz., colour sensation and colourless sensation. The author describes in detail the structure of tbe retina during the process of adaptation, and adopts the nomenclature ***photopic*** (Parsons), i.e., the eye under condition of bright illumination, and ***scotopic***, i.e., the eye adapted for dark.

The photopic eye sees all objects distinctly, both for form and colour. As the illumination decreases, colours fade according to the Purkinje phenomenon until we are able to perceive only the form of objects. Under the conditions of complete darkness there are

no visual sensations at all, the eye having become adapted for the dark, i.e., scotopic.

Whether one accepts the visual purple theory of Edridge-Green, or the duplicity theory of v. Kries, the formation of visual purple is seen to be at least the basis of dark adaptation. According to the former, the visual purple, liberated from the rods, is conducted by a series of canals to the sensitive spot of vision (fovea), and having undergone photo-chemical decomposition, it stimulates the ends of the cones with which it comes into contact. The cones receive stimuli, varying according to the wave length of the light experienced, and the impulse is passed to the optic nerve fibres, thence to the brain. The alternative theory holds that achromatic scotopic vision takes place through the medium of the rods alone, the cones being the organs of photopic vision. In chromatic scotopia both rods and cones are implicated. We cannot perceive colours unless the light stimulus is above a certain intensity (the specific or colour threshold of Parsons). Below this is an interval of achromatic light perception, which increases as the eye becomes adapted for the dark. It is with this interval that the experiments dealt with in the paper are concerned.

The radio-active substance used for luminous watch dials becomes constant in luminosity at the end of a year, and seemed to furnish an ideal light stimulus of constant value and low intensity. Several discs of uniform size, impregnated with the commercial substance, were kept in the author's possession for a year. At the end of this time the discs were calibrated.

The standard taken was that disc which just gave the sensation of light to the author on passing from a well-lighted room at midday into a photographic dark room, i.e., the disc which proved to be the minimum light stimulus for his light-adapted eye. A series of discs of similar intensity was covered with successively increasing layers of celluloid. The author found that the disc, covered by five layers of celluloid, represented the minimal light sense for his dark-adapted eye (the experiment being carried out at night, after he had spent two hours in an absolutely dark room).

In the photometer described, six discs were mounted on a circular plate, the luminosity of the discs, ranging in series from the uncovered substance, to that covered by five layers of celluloid. Thus he obtained a series of six light-stimuli of different degrees of intensity, necessary for retinal adaptation whether in the photopic or the scotopic eye. The plate carrying the six luminous discs is contained within an upright box, and is rotated by a handle so as to bring the discs in turn opposite the eyepiece. The eyepieces are fitted with slides which can be removed as desired, a leather cuff being attached to render the apparatus light-proof when fastened tightly over the observer's face by means of tapes. The discs are

7 mm. in diameter, and the distance from the eye is 10.5 cm. The retinal image is, therefore, 1 mm., and subtends a visual angle of 4 degrees. At the beginning of the test an opening in the plate is placed opposite the eye; the first disc (uncovered by celluloid) is then rapidly rotated into place, when the observer should at once see it. The "blinders" are then closed, and the observer sits with his eyes darkened for ten minutes, at the end of which time the test is repeated, and the time at which the first disc becomes visible is noted. The wheel is then rotated so that the discs of weakest intensities are seen first, and the observer proclaims the exact moment at which he sees the luminosity. The number of this disc is recorded in the fraction—the numerator being the observer's minimum light sense, and the denominator that which is taken to be the normal. After ten minutes in complete darkness the disc, covered by four layers of celluloid, should be seen, and for the normal eye ten minutes should be sufficient to produce full scotopia.

Numerous supplementary experiments were performed to establish the reliability of the test under varying conditions, e.g., the first disc always represented the minimum light stimulus not only for the eye adapted to ordinary conditions of illumination, but also for conditions of excessive light. In the latter case, however, there was a delay of 30 seconds, corresponding to the extra strain put upon the re-formation of the visual purple in the light-exhausted eye. To obtain uniform results the observer should sit in a moderately lighted room for a time before the test is made. Delay beyond 60 seconds in seeing the first disc indicates slow dark adaptation. The disc, covered by four layers of celluloid, should be seen by normal eyes after full dark adaptation. If the power of dark adaptation be less than normal, the eyes should be submitted to a second period of dark adaptation (10 minutes), and the result recorded in the form of a fraction as described.

Dark adaptation occurs in each eye independently, the condition of the other eye being found to have no influence on that of the eye under examination. The retina was found to react whether tested in whole or in part—the experiments being successful with a small aperture in the same way as with the ordinary eyepiece. The experiments went to show that there is marked adaptation *at the macula, and in the rod-free area thereof.* At the exact fovea there is very slight adaptation.

Downey presents his findings as in a large measure confirmatory of the work of others, and modestly alleges that his instrument and experiments are elementary.

J. HAMILTON MCILROY.

IV.—EXOPHTHALMOS IN GRAVES'S DISEASE

Moore, R. Foster (London).—A note on the exophthalmos and limitation of the eye movements of Graves's disease. *Lancet*, October 2, 1920.

In this short article **Foster Moore** leans to the conclusion that exophthalmos and limitation of movement of the eye in Graves's disease are due to excess of orbital fat. He points out that there have been three explanations, namely: (1) Irritation of the sympathetic; (2) engorgement of the orbit with blood; (3) increase of the orbital fat. The first two receive support from the statement that after death the proptosis disappears. On the other hand, the statement may not be true, and also the anatomical proof of the existence of the requisite muscle tissue appears to be wanting. The orbital fat theory is supported by Moore's experience on two occasions. On the first, a dissection of the orbit in a patient dead of this disease, the diminution of the exophthalmos was merely such as might be accounted for by the draining of blood from the orbit after death, while undoubtedly the orbit was "full to overflowing" with fat. The second case was one in which the exophthalmos was so extreme that something had to be done to save the cornea of one eye, the proptosis being less marked on the other side. Through an incision extending the whole length of the inferior fornix, Moore removed an amount of fat estimated as equivalent to a heaped-up teaspoonful. On exploration with the finger nothing but soft fat was felt. In addition, however, the fat was oedematous, as were also the bellies of the recti muscles exposed. After the removal of the fat the lids could be approximated, and were stitched together, and the cornea saved. The author is aware of the statement that proptosis may develop very rapidly, which would militate against the fat theory, and suggests that this is really due to sudden development of retraction of the upper lid simulating proptosis, or unmasking a proptosis hitherto unnoticed. Limitation of movement Moore considers to be mechanically produced by the pushing forward of the eye, oedema of the muscles being a factor in that it impairs the muscular functions.

ERNEST THOMSON.

V.—REMEDIES

(1) **Jocqs, R. (Paris).—The treatment of dacryocystitis by cauterization with 50 per cent. chloride of zinc, compared with extirpation of the sac. (Le traitement de la dacryocystite par la cauterisation au chlorure de zinc à 50 pour cent., comparé à l'extirpation du sac.)** *La Clin. Ophtal.*, May, 1920.

(1) In cases of dacryocystitis, where the anterior wall of the sac is intact, and where it is specially desired to avoid as far as possible the making of a visible cicatrix and subsequent lacrymation, **Jocqs** employs a method by which all the mucous membrane, except that at the very bottom of the sac, is destroyed with chloride of zinc, 50 per cent. The minute details of the method should be sought in the original. The only disadvantage of the method is that it occupies 15 days altogether, whereas excision, if immediate healing takes place, is much shorter.

ERNEST THOMSON.

(2) **de Peyrelongue, Prof. (Beyrout). — The treatment of trachoma by the new method of Dr. Abadie. (Le traitement du trachome par la nouvelle méthode du Dr. Abadie.)** *La Clin. Ophtal.*, June, 1920.

(2) On page 424 of the BRITISH JOURNAL OF OPHTHALMOLOGY for September, 1920, will be found an abstract of Abadie's method for treating trachoma. In the article now under consideration, **de Peyrelongue** relates the treatment by this method of forty cases of trachoma of various types. It is only necessary to state the conclusion of the author, that Abadie's method has given in these cases excellent and rapid results.

ERNEST THOMSON.

VI.—EYE COMPLICATIONS OF MALARIA

Manson, W. Hislop (Glasgow).—Personal experience of the ocular sequelae of malaria. *Glasgow Med. Jl.*, March, 1920.

Manson, when on service, passed through his hands not fewer than 12,000 cases of malaria. He briefly relates the ocular conditions found. Practically every attack is followed by a slight icteric tinge of the conjunctiva. It is a suggestive symptom in cases of pyrexia of uncertain origin. Ulceration of the cornea was the most frequent sequela as regards the eyeball. It was an

accompaniment of relapses, not of the primary infection, the infecting parasite being of the benign tertian variety. The ulcers tend to be of the dendritic type, usually affect the centre of the cornea and may extend to the deeper layers. They cause marked diminution of vision, are painful and heal slowly, and are often accompanied by iritis. They are liable to recur with each subsequent attack of malaria. Douching with normal saline and the instillation of atropin was found to be the best local treatment. Except as a complication of ulcer, iritis did not occur. Intraocular haemorrhage (subhyaloid) occurred in two cases where the infection was by the malignant tertian parasite. Ocular paralyses occurred in three cases as sequelae. Wassermann was negative in each and there was no reason to suspect syphilis. These three cases were respectively: paresis of external rectus greatly improved under anti-malarial treatment; paresis of accommodation which recovered completely; and total ophthalmoplegia of one eye ten days after an attack of malaria. In the last case there was no recovery, as regards the paralysis. Neither quinine toxic amblyopia nor quinine optic atrophy occurred but there were two cases of quinine amaurosis. One recovered completely. The other became totally blind. In both cases a minimum of 80 grains had been taken in one dose.

ERNEST THOMSON.

VII—DIURNAL CURVE OF INTRA-OCULAR PRESSURE

Pissarello, C.—Daily curve of ocular tension in normal and glaucomatous eyes modified by miotics and operation. *Iowa St. Med. Soc. Jl.*, Vol. VI, No. 3.

Pissarello finds that under conditions of normal health, the ocular tension remains constant in any one individual, but differs greatly in different individuals. On the other hand, it varies very greatly from time to time in the same individual when suffering from glaucoma. He finds that there is a definite tidal periodicity in the rises and falls of tension in glaucomatous eyes, the highest records being met with about midday and the lowest in the evening. There is a subsidiary rise in the afternoon. The tension tends to fall after meals, and is therefore influenced by the hours at which these are taken. The curve of the tensions tend to show a rise from day to day. It is influenced by miotics, but much more strongly so by derivative treatment. He lays stress on the necessity of taking the tension at intervals during the day and of charting the results on the same lines as those on which we chart temperatures. He gives the following advice as to treatment: (1) Divide up the

meals of glaucomatous patients as much as possible; (2) Fix the hour for operation at a time when the tension of the eye is found to be lowest as judged by daily observation; (3) Regard miotics as impotent to cure glaucoma; of these drugs pilocarpin is to be preferred, its use should be uninterrupted; its action in lowering tension is not in constant relation with that in contracting the pupil. He is in favour of iridectomy, which has served him well, rather than of irido-sclerectomy.

R. H. ELLIOT.

VIII.—KERATOCONUS CONSECUTIVE TO VERNAL CONJUNCTIVITIS

Gonzalez, Dr. José de J. (León, Guana Juata, Mexico). *Amer. Jl. of Opthal.*, Feb., 1920.

Gonzalez in a modest note makes a useful contribution to the subject of vernal conjunctivitis, where he points out the possibility of the disease being followed by astigmatism (irregular) or keratoconus, complications which are very serious in youth. Ametropias occurring in patients who have suffered from protracted vernal conjunctivitis, in his opinion, are certainly due to the conjunctival disease. He has had a large experience of this condition over consecutive years, and is able to make observations in regard to the progressive nature of the ametropia. One case, a child of 10 years, had been under treatment for vernal conjunctivitis since she was five years old. Refraction had been normal until recently, when she was presented not on account of the conjunctivitis (which had disappeared), but for failing vision. In one eye there was myopic astigmatism (—3 D.—4 D.) and in the other high myopia (—13 D.) with some irregular astigmatism. The high myopia was accompanied by keratoconus. Gonzalez urges brisk treatment of vernal conjunctivitis in the early stages, in order to avoid the danger of ametropia and corneal deformities.

J. HAMILTON MCILROY.

IX.—OPERATIONS

(1) **Falchi (Pavia).—Peripupillary combined cystotomy.** *Arch. of Ophthal.*, Vol. XLVI, No. 2, p. 135.

(1) Under this somewhat cumbersome appellation, **Falchi** describes his operation for after-cataract. He makes a keratome incision at the limbus, introduces a cystotome, and with it cuts the after-

cataract away from the pupillary margin of the iris. He then removes the membrane with a pair of forceps, provided that it does not sink into the hyaloid body, and that there has been no vitreous loss at the first operation. The second operation was attended by loss of vitreous in two cases out of twenty-one. Details are furnished as to the best cystotome to employ. The operation seems to the reviewer to be needlessly complicated and dangerous.

R. H. ELLIOT.

(2) **von Hippel (Göttingen).—Successful operation in post-traumatic detachment of the retina. (Erfolgreiche Operation bei posttraumatischer Netzhaut-ablösung.)** *Klin. Monatsbl. f. Augenheilk.*, July-August, 1915, p. 146.

(2) **von Hippel's** patient had been shot in the face sixteen years previously. The left eye had been removed. In the right eye could be seen a round band in the vitreous passing back to a point outside and below the papilla. There was also an extensive detachment of the upper half of the retina extending down to the papilla and the macula. The detachment increased rapidly and in a few days was almost total. It was decided to divide the vitreous band with scissors rather than by the method of Deutschmann. The conjunctiva was divided below the tendon of the rectus internus and the sclera by a meridional incision. The wound edges were separated by hooks, and with the aid of concentrated electric light the band was easily seen and divided without any traction. In three days the field of vision had become normal for hand movements in reduced light, and on the sixth day the retina was adherent all over. A fortnight later the patient was about again; vision with $-8{\cdot}0$ D.$=5/20$, field normal, retina everywhere attached. The divided ends of the vitreous band could be seen. At the end of a year the condition remained unaltered.

In another somewhat similar case this procedure was not successful. Elschnig concludes that, especially in late detachments after perforating wounds, such cases should receive careful consideration as to their suitability for this type of operation.

H. M. TRAQUAIR.

(3) **Landolt, Marc.—A simple method of suturing the sclerotic with a conjunctival cover. (Un procédé simple de suture de la sclérotique avec recouvrement conjonctival.)** *Arch. d'Ophtal.*, March-April, 1916.

(3) **Marc Landolt** points out the necessity for a rapid and simple form of suture for wounds of the sclerotic. He uses a fine suture of silk armed with two fine needles. He first frees the conjunctiva for a considerable distance and then passes the two needles through

the conjunctiva some 8 mm. from the wound. The amount of separation between the two needles obviously depends on the length of the wound. After passing under the conjunctiva the needles are passed through the substance of the sclerotic on both sides of the wound and then turned back once more under the conjunctiva of the original side of entry and brought out about 4 mm. from the wound in the sclerotic. The needles are then removed and the silk knotted, thus at one and the same time closing the wound in the sclerotic and sliding the conjunctiva over it, A diagram that accompanies the paper makes the method quite clear. E. E. H.

(4) **Bourguet (Toulouse) and Ronnaux (Paris).—Double optic neuritis cured by puncture of the corpus callosum. (Double névrite optique guérie par la ponction du corps calleux.)** *Ann. d'Oculistique*, July, 1916.

(4) **Bourguet** and **Ronnaux** record a case of double optic neuritis cured by puncture of the corpus callosum. The patient was a prisoner of war, aged 24, who had an attack of influenza in the beginning of February, 1916, and was transferred to the care of the authors on the 28th of that month with vision: R.E. (?); L.E. 1/8; frontal headache, slight vertigo, and double optic neuritis. There were no other symptoms of intra-cranial tumour, and syphilis, rheumatism, albuminuria, and glycosuria were excluded. In the absence of any other cause the authors came to the conclusion that the foramen of Majendie was blocked from inflammation resulting from the influenza leading to accumulation of fluid in the ventricles and producing a sort of tension which caused the optic neuritis, headache and vertigo. With a view to reducing this tension by re-establishing communication between the ventricles and the sub-dural space, they made an opening through the corpus callosum. Two days after the operation the vision had improved to 1/6 in each eye and two and a half months later it was R. and L. 1, and the optic discs were normal. On the evening of the operation the patient developed loss of sensation in the whole of his body below the umbilicus. The motor power of his lower limbs was unimpaired. In ten days sensation began to return and when the article was written it was normal except on the soles of the feet where there was a slight defect.

The operation was performed as follows: Under local anaesthesia a trephine opening was made 1½ centimetres outside the middle line, the dura mater was incised, a canula 9 cm. long was passed under the dura mater to the cerebral cortex tangentially towards the middle line until it struck the falx cerebri then rotated into a vertical position and passed downwards along the falx until it struck the corpus callosum. This was perforated by pushing the

canula through it to a depth of 1.5 cm., and the opening was enlarged by backward and forward movements. The canula was then withdrawn and the skin wound was sutured.

W. C. SOUTER.

(5) **Wieden.—Complete restoration of the orbital cavity by means of skin grafts, for the artificial eye. (Restauration total de la cavidad orbitaria por medio de injertos dermicos para la próteris ocular.)** *Arch. de Oftal. Hispano-Amer.*, January, 1917.

(5) In this paper, read at the tenth assembly of the Spanish-American Ophthalmological Society, held at Valencia, **Wieden** relates the case of a young girl who was injured in the right orbit by a revolver bullet. The eye was so badly damaged that it had to be removed at once, and the bullet, which was lying at the back of the orbit, was removed at the same time. The patient made a good recovery, with complete ankyloblepharon as a result of her injury.

Subsequently operations in two stages were undertaken under local anaesthesia to remedy the existing deformity, and to allow of an artificial eye being worn.

The first stage of the operation consisted in dividing the cicatricial tissues between the two lids, and in separating the lids from the underlying scar tissue, the conjunctiva was found to be folded up and it was unrolled, so as to cover about 12 mm. in depth of the posterior surface of the upper lid, and about 8 mm. of the lower lid. The graft was cut from the skin of the inner side of the arm, and was fixed in position to cover the top part of the cavity by numerous fine points of suture. Once in position, the cavity was packed with pledgets of iodoform gauze steeped in scharlach red, and a pressure bandage was applied over all; while the patient was kept quiet in bed. On the fourth day the superficial dressing was removed, and on the eighth day the graft was seen to be healthy; six days later the sutures were removed, while the pressure bandage was maintained till the end of the month, when the graft was found to have taken completely, and the socket was already of sufficient size to allow of a small eye being worn.

About two months afterwards the lower lid and the lower part of the socket cavity was dealt with in a similar manner. Photographs of the patient during the various stages of this treatment show the results very well. The final result appears to be excellent.

Wieden's conclusions are shortly as follows: "These cases are long ones and much patience is required. One must not try and

begin too soon after the original injury. Rigorous asepsis is necessary. The grafts must be one-third larger in size than the surface to be covered, the skin must be fine, free from hairs and from fat. Most perfect adaptation of the graft to the underlying tissues is essential.

Rapidity in operating and complete haemostasis are necessary. The operation should be done in two stages, a few months interval between the two. Finally, it is possible to restore completely the socket by these means, even when the conjunctiva has completely disappeared."

The immediate result in this case seems to be excellent, and we see no reason why the cure should not be permanent. Contracted sockets are not very easy cases to deal with. At the present time there must be a fair number of wounded soldiers who are in very much the same state as Wieden's patient was after her initial injury, and it seems to us that this method of treatment might well be given a trial in suitable selected cases, to remedy their deformity.

R. R. JAMES.

(6) **Green, John (St. Louis, Mo.)—Scleral trephining in detachment of the retina.** *Arch. of Ophthal.*, Vol. XLVI, No. 2, p. 104, 1917.

(6) **Green** comments on the very unsatisfactory results that have attended various methods for the treatment of detachment of the retina. The method most in favour with American ophthalmologists would appear to be scleral puncture. Schreiber's scleral trephining, which was accompanied by incision of the protruding button of choroid, is described first. Tiffany and Parker both independently employed trephining. The former excised the protuding button of choroid, whilst the latter contented himself with incising the uveal tissue, and, if necessary, the retina as well. Curtin cut out a disc with the trephine, replaced the conjunctiva, waited for ten days, and then removed the effused fluid by aspiration with a hypodermic syringe. Thomson and Curtin found that "the evidence on all sides is in favour of some operative procedure which withdraws the subretinal and suprachoroidal fluid." Finally, Holth has introduced the operation of "pre-equatorial sclerectomy," which consists in making a meridional incision in the sclera, and excising one lip of it with a punch-forceps. Five case-reports of eyes trephined for retinal detachment are furnished. Green thinks an operation for the withdrawal of the subretinal and suprachoroidal fluid is the rational treatment, and that, if this is admitted, then the sooner it is done the better.

R. H. ELLIOT.

(7) White, Daniel W., and White, Peter Cope (Oklahoma).—New operation for canthoplasty with special technic in cases due to trachoma. *Ophthal. Rec.*, March, 1917.

(7) **White** and **White** describe some of the causes of failure in the operation of canthoplasty, and draw attention to the necessity of cutting the fibres of the external lateral ligament in a vertical direction upward and downward from the initial horizontal incision as described by Casey Wood. The author's operation consists in freely separating the skin from the underlying tissues above and below the horizontal incision; these skin flaps are then carefully sutured so that the edges are evenly inverted. The canthal ligament is now cut vertically upwards or downwards and some of the fibres of the levator palpebrarum are cut at the same time. Then the conjunctiva at the apex of the wound is loosened from the underlying tissue and also for a short distance from the upper and lower lids, in such a way as to reach the fornix conjunctivae so that when the conjunctiva is put on the stretch the mobility of the globe is not interfered with. The conjunctiva is then sutured to the skin above and below near the fornix and at the external angle of the wound.

In cases of advanced trachoma with shrinking of the conjunctiva it is difficult to draw it into the skin wound and suture it there. In these cases the tarsal plate and the palpebral conjunctiva are removed. The fornix conjunctivae is stretched toward the outer canthus and the suture is now placed somewhat to the inner side of the outer canthus, thus giving the conjunctiva at the outer canthus a little more play. After the removal of the tarsus and conjunctiva there will be no apparent shrinking of the conjunctiva at the outer canthus and it can be sewed very easily to the wound. In xerotic cases—shrinking of the conjunctiva without trachomatous tissue, the tarsus alone without the conjunctiva need be removed. The removal of the tarsus or tarsus and palpebral conjunctiva should be done at least one month before the canthoplasty, as the results are better than when the two operations are done at one sitting.

J. JAMESON EVANS.

(8) Woodruff, H. W. (Jollet).—Tendon transplantation of the eye muscles. *Ophthal. Record*, November, 1917.

(8) **Woodruff** remarks on the comparative infrequency of the operations for tendon transplantation by ophthalmic surgeons, who generally prefer to attempt the restoration of the function of a paralyzed muscle by its advancement, and a tenotomy of the contracting opponent—a method which may have good results in incomplete paralysis, but in complete paralysis the writer has never secured a satisfactory result by these means.

He advocates that the action of a paralyzed muscle be replaced by substitution of one or more of the normal muscles in its proximity. In the case of a paralyzed external rectus, the outer halves of the superior and inferior recti were sutured to the tendon of the paralyzed muscle, whilst the internal rectus was freely tenotomized. Two cases are reported but in neither case was there any movement outward beyond the median line; in one case he claims a cosmetic improvement.

J. JAMESON EVANS.

(9) **Green, A. S. and L. D. (San Francisco).—Extraction of cataract in the capsule (Smith's operation) cinematographed.** *Ophthalmology*, 1917, p. 406.

(9) The authors of this article are to be congratulated on their enterprise and thoroughness for going to India to study Smith's operation at first hand, introducing it whole-heartedly in their practice up to the number of 196 extractions on American patients, and, finally subjecting the operative steps to the cinematograph. While it is impossible to reproduce the photographic record, the authors have done extremely well in portraying the operation by means of 18 selected negatives from the record. The reproduction on glazed paper of enlarged prints from these negatives is everything that can be desired in all but two, which are hardly so good. Accompanying the prints is a minute description of the steps of the Smith operation commencing with the examination and preparation of the patient. The only modification, the authors say, which they have made is in regard to the actual speculum used. For a minute description of the operation readers who wish to study it could hardly do better than consult this article.

ERNEST THOMSON.

(10) **Landolt, E. (Paris).—Concerning advancement of ocular muscles. (A propos de l'avancement musculaire.)** *Arch. d'Ophtal.*, March-April, 1918.

(10) In the *Archives d'Ophtalmologie*, Jan.-Feb., 1918, Terrien published an article on advancement of ocular muscles in the treatment of strabismus, in which he advocated the employment of a complementary suture intended to counteract the loosening of the newly attached muscle from tearing of its cut end by the stitches.

Landolt now writes that, in his experience, this second suture is unnecessary, and that he guards against a diminution of the effect of the advancement by an initial over-correction of the squint. He lays emphasis upon the expediency of this over-correction, and also upon the advisability of keeping both eyes bandaged for a week after the operation.

J. B. LAWFORD.

(11) **Van Lint (Brussels).—Muscular advancement with reinforcing suture at its insertion. (Avancement musculaire avec suture de renforcement à l'insertion du muscle.)** *Bull. et Mémoires de la Soc. française d'Ophtal.*, 1919.

(11) The author begins by stating that a successful advancement operation must fulfil two points; it must involve no danger to the eyeball and must insure firm union at the new insertion. In the above operation the first point is assured by making use of the tendinous insertion close to the globe instead of penetrating the sclerotic, and the second is fulfilled by making use of two different sets of suture, one uniting the muscle belly to its old insertion, the other its cut end to the conjunctiva.

The operation, which is illustrated by diagrams, is as follows: a horizontal section is made of the conjunctiva over the muscle and the latter is laid bare for a full centimetre and placed over two strabismus hooks. A catgut suture (No. 0) armed by two needles is passed from behind forward through the tendinous insertion as close to the sclera as possible and then passed through the muscle belly as far back as considered necessary, also from behind forward. The muscle is now seized with advancement forceps about 5 mm. from its insertion and divided; it is drawn forward while the eyeball is rotated to meet it so that the belly of the muscle is brought over the site of insertion and the catgut suture is then tied and cut short. The cut end of the tendon now lies, of course, close to the limbus and is secured by two silk sutures, one through the upper and one through the lower border. These are doubly armed and brought out through the conjunctiva at the 7.30 and 10.30 position of the globe. A third suture brings the cut edges of the conjunctiva together.

A binocular bandage is applied, glasses are worn on the sixth day and on the eighth the sutures are removed. The dressings should be changed every day and over-correction should be the rule. No tenotomy should be done at the time and is rarely necessary afterwards.

CHARLES KILLICK.

CORRESPONDENCE

"TROPICAL OPHTHALMOLOGY"

To the Editor THE BRITISH JOURNAL OF OPHTHALMOLOGY

SIR,—In his all too generous review of my book on "Tropical Ophthalmology," Colonel Herbert draws attention to the fact that in the description of the Madras cataract operation, no reference

has been made to the necessity of moistening the cornea during operation, and thinks that the keratitis mentioned on page 262 may be due to the omission of this very necessary precaution in tropical work. I should be very sorry to give the impression that I do not value the moistening of the cornea. I am wholly in agreement with him on the subject, and it has always been the custom in Madras to use an irrigator very freely for this and other purposes.

I have broken my rule of never answering reviews, driven by the fear that the impression conveyed to so able a critic as Colonel Herbert might be shared by others of less experience, and so lead some beginners to omit a measure on whose necessity I am absolutely in agreement with my reviewer.

Yours truly,

R. H. ELLIOT, Lt.-Col. I.M.S., Retired.

Oct. 31st.

MODIFIED ANGELUCCI'S FIXATION

To the Editor of the BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIR,—I have now adopted as a routine measure, a modification of Angelucci's method of fixation in cataract and other intra-ocular operations. I pass a silk suture through the superior rectus tendon, and bring the two ends separated on to the forehead, where an assistant fixes them with his fingers; the lid is thus held firmly out of the way while the eye is rotated downwards, it is impossible for any pressure to be put on the eyeball, the suture can be released instantaneously without the manipulation necessary with a speculum, which can be dispensed with, and while fixation forceps can be used for the section in cataract, they are unnecessary afterwards.

Yours faithfully,

W. H. BRAILEY.

LANSDOWNE PLACE, HOVE,
October 17, 1920.

BOOK NOTICE

Clinical Ophthalmology for the General Practitioner. By A. MAITLAND RAMSAY, M.D., with foreword by Sir JAMES MACKENZIE, M.D., F.R.S. London: Henry Frowde, Oxford University Press, and Hodder & Stoughton. 1920. Price 42s. net.

In undertaking to write a book on "Clinical Ophthalmology for the General Practitioner," the author set himself a novel task and one not free from difficulty. Whether or no his attempt has been successful, i.e., whether he has given the man in general practice

what he wants, must be determined by practitioners themselves. With a negligible experience of general practice we feel that our judgment on this question is valueless. We do, however, feel competent to express an opinion on the intrinsic merits of the book, an opinion entirely favourable to it, and congratulatory to the author.

The book is well written, well illustrated and well printed, and undoubtedly fills a gap in ophthalmological literature.

We have read it with interest and pleasure, and although we have to justify the position of reviewer by some criticism, we heartily commend the book to the general practitioner and others interested in ophthalmology.

The volume contains 500 pages, of which the text occupies 410 pages: the remainder is devoted to therapeutic notes and formulae (61 pp.), a glossary of ophthalmological terms and derivations, and an index.

It is admittedly difficult, when writing on a special subject, for those who are not, and do not intend to be, specialists therein, to know when to stop; the author's aim, as set forth in the preface "has been to indicate, as far as possible, the cases which the general practitioner can treat safely on his own responsibility, and those in which it is desirable to obtain a consultation with an expert." It seems scarcely in accord with this aim to give detailed instructions for the performance of operations, e.g., for cataract, and for intra-ocular foreign bodies, which few general practitioners would care to undertake. Those, however, who desire to operate, or are compelled to do so, will obtain all the help that written descriptions can afford from the author's clear and decisive words of advice.

The arrangement of the contents seems to us excellent. The first and second chapters on "The Methodical Examination of the Eye," and "Important Symptoms in Diseases of the Eye," will furnish the reader, even one quite alien to ophthalmology, with a knowledge of first principles which should prove very helpful in further study and in the examination of cases. The subsequent forty-three chapters all reach so high a standard that criticism is disarmed. One (chapter 36) which, though not clinical, will prove of great practical assistance to many medical men, is that on "Eye Injuries with Special Reference to the Workmen's Compensation Act, 1906."

The big things of this book are so good that it would be paltry to find fault with details, and we, therefore, pass by certain minor matters concerning which we are not wholly in agreement. We envy the author his obviously robust faith in the efficacy of drugs.

The illuminations consist of twenty full page plates, eleven of which are in colours. Most of the plates contain three to six figures. With few exceptions they are very good, and, we think, have been well selected for the readers whom the book is designed to serve.

Plate 18, in our view, might have been made more intelligible to the inexperienced if the false images had been connected by a dotted line with that part of the retina of the deviating eye from which they are projected. The illustration of *iris bombé* (plate 10, fig. 1) is not at all realistic.

The Oxford University Press have taught us to expect something approaching perfection in regard to printing and freedom from typographical errors in books issued by them. This work sustains their reputation. Of the very few mistakes noted, attention may be directed to two. Credé's name is anglicized so that by the uninitiated it will be pronounced as Creed, and the synonym of choked disc is given as "Stauung's papilla."

Sir James MacKenzie's foreword is full of rugged common sense, and we wish that it might be read by all those who propose to become the authors of books on medical subjects.

NOTES

Death

WE regret to announce the death on October 10, 1920, of Thomas Henry Delany, Lt..-Col. I.M.S. (retired), of Dublin. He was Assistant Surgeon to the Royal Victoria Eye and Ear Hospital, and Hon. Secretary and Treasurer of the Irish Ophthalmological Society.

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Appointments

DR. A. H. H. SINCLAIR has been appointed an ophthalmic surgeon and Dr. E. H. Cameron an assistant ophthalmic surgeon to the Edinburgh Royal Infirmary.

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Elections

AT a meeting held on October 20, Dr. George MacKay was re-elected President of the Royal College of Surgeons of Edinburgh. Dr. Freeland Fergus has been re-elected President of the Royal Faculty of Physicians and Surgeons of Glasgow. Mr. R. H. Dickson, of Newcastle, Staffs., has been elected President of the North Staffordshire Medical Society.

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Royal Society of Medicine

LACK of space precluded our mentioning in the last number more than the names of the President and Secretaries for 1920-21 of the Section of Ophthalmology of the Royal Society of Medicine. The list is completed below: *Vice-Presidents*—E. Treacher Collins, William Lang, A. Maitland Ramsay, J. B. Story, E. E. Maddox, Sir Arnold Lawson, K.B.E., W. T. Holmes Spicer. *Other Members*

of Council—A. W. Ormond, C.B.E., J. Herbert Parsons, C.B.E., G. H. Pooley, T. Snowball, Gordon Holmes, C.M.G., C.B.E., H. L. Eason, C.B., C.M.G., J. F. Cunningham, O.B.E., R. A. Greeves, W.W. Sinclair, Bernard Cridland, James Collier, Leslie Paton, R. R. Cruise, C.V.O., D. Leighton Davies, Lieut.-Colonel H. Herbert, I.M.S., F. A. Juler, G. W. Thompson, S. A. Kinnier Wilson. *Representative on Library Committee*—J. Herbert Parsons, C.B.E. *Representative on Editorial Committee*—Malcolm L. Hepburn.

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Protection of the Eye in Welding Operations

AT a recent meeting of the Acetylene and Welding Association an interesting survey was given by Mr. R. P. Butler of the nature of the injuries caused to the eyes in welding operations and an analysis of the kinds of glass used for protective purposes. He pointed out that in this country there was no official standard of these glasses, and suggested that the Association should issue some form of certificate that would be a guarantee that the certified glasses did confer proper protection on the eyes.

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Council of British Ophthalmologists

THE need for institutional treatment of children suffering from contagious eye disease has been engaging the attention of the Council of British Ophthalmologists. On October 20 a deputation from the Council visited the Ministry of Health and was received by Sir George Newman on behalf of the Minister of Health.

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Blind Masseurs

ST. DUNSTAN'S HOSTEL for Blinded Soldiers and Sailors has opened a massage and electro-therapeutic clinic at 18, Christopher Street, E.C., where the operators are blinded men trained at St. Dunstan's. The accommodation secured will allow of 40-50 patients being treated daily, and the rooms are equipped with all necessary apparatus. A blinded officer, Captain Ian Fraser, is in charge of the clinic.

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Oxford Ophthalmological Congress

THE next meeting of the Congress will be held at Keble College, Oxford, on July 6, 7, and 8. The discussion, to be opened by Dr. Victor Morax, will be on "The Causes of Infection after Extraction of Senile Cataract." The Doyne Memorial Lecture, by Mr. E. E. Maddox, will deal with "Heterophoria."

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Corrigendum

BY an unfortunate oversight, Dr. W. J. Rutherfurd's name was wrongly spelled in our June issue.